LA 20-05BM

INSTRUCTION MANUAL

FOR

REGULATED POWER SUPPLIES

LA 20-05B

LA 20-05BM

LAMBDA ELECTRONICS CORP. MELVILLE, L. I., NEW YORK

SPECIFICATIONS AND FEATURES

Specifications apply for both the unmetered model LA 20-05B and the metered model LA 20-05BM.

DC OUTPUT -- Regulated for line and load

Voltage Range	20-105 volts DC (in 16 continuous overlapping bands)
Voltage Range Bands	20-30, 25-35, 30-40, 35-45, 40-50 45-55, 50-60, 55-65, 60-70, 65-75 70-80, 75-85, 80-90, 85-95, 90-100 95-105
Current Range	0-2 amperes (for entire voltage range)
Regulation (line)	Better than (0.05) percent for input variations from 105-140 VAC
Regulation (load)	Better than (0.10) percent for load variations from 0 to full load
Transient Response (line)	Output voltage is constant within regulation specifications for step-function line voltage change from 105-140 VAC or 140-105 VAC
Transient Response (load)	Output voltage is constant within regulation specifications for step-function load change from 0 to full load or full load to 0 within 50 microseconds after application
Internal Impedance	Less than 0.06 ohm
Ripple and Noise	Less than 1 millivolt rms with either terminal grounded
Polarity	Either positive or negative terminal may be grounded
Temperature Coefficient	Within 0.025%/°C of output voltage

AMBIENT TEMPERATURE AND DUTY CYCLE -- Continuous duty at full load up to 50°C (122°F) ambient

AC INPUT -- 105 - 140 volts AC, 60±0.3 cps* 390 watts**

* This frequency band amply covers standard commercial power lines in the United States and Canada.

** With output loaded to full rating and input at 140 VAC

OVERLOAD PROTECTION

Electrical.....Magnetic circuit breaker, front panel mounted. Unit cannot be injured by short circuit or overload.

Thermal.....Thermostat, manual reset, rear of chassis. Thermal overload indicator light, front panel.

INPUT AND OUTPUT CONNECTIONS -- Heavy duty barrier terminal block, rear of chassis.

METERS -- Voltmeter and ammeter on metered models

CONTROLS

DC Output Controls.....Voltage band switches and adjustable VERNIER control, rear of chassis.

Power.....Magnetic circuit breaker, front panel.

Remote DC Vernier.....Provision is made for remote operation of DC vernier.

Remote Sensing.....Provision is made for remote sensing to minimize effect of power output leads on DC regulation.

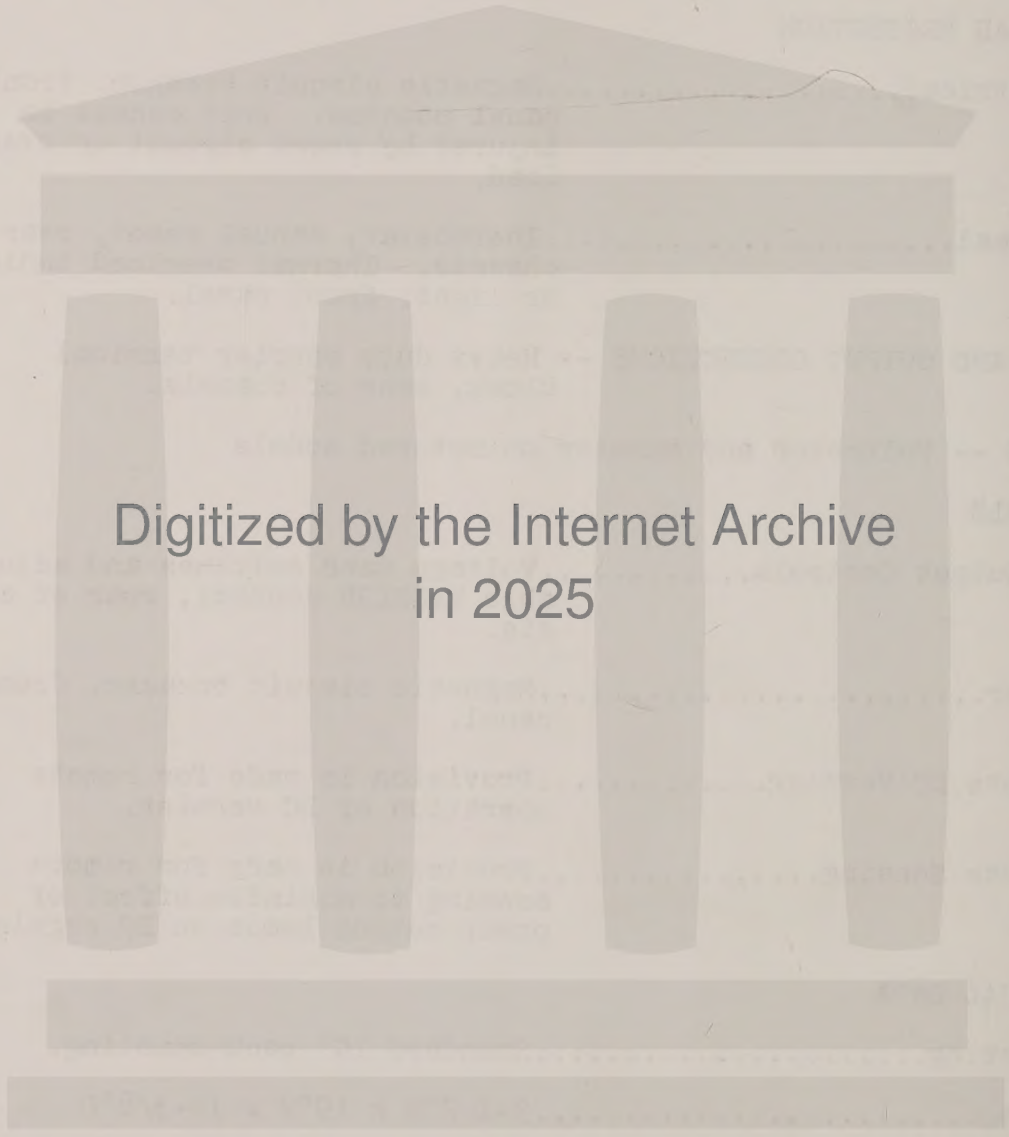
PHYSICAL DATA

Mounting.....Standard 19" rack mounting.

Size.....3-1/2"H x 19"W x 14-3/8"D

Weight.....55 lbs. net, 85 lbs. shipping wt.

Panel Finish.....Black ripple enamel (standard). Special finishes available to customer's specifications at moderate surcharge.



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OPERATING INSTRUCTIONS

CONTROLS, INSTRUMENTS AND FUSES

ON-OFF Circuit Breaker.

The ON-OFF circuit breaker, located on the front panel, controls application of input power to the supply. Overload of the supply causes the breaker to trip. When the breaker is in the ON position the POWER ON indicator lamp glows.

Output Voltage Controls.

1. Range Switches. Range switches S1, S2, S3, and S4, together with the VERNIER, select the DC operating voltage band. The DC output voltage (VDC) is the summation of these voltages.

$$VDC = 20 + S1 + S2 + S3 + S4 + Vernier$$

Set the switches and VERNIER to the positions listed in table 1 for the particular operating voltage range.

Table 1 Selection of Operating Voltage

Range VDC	Switch Positions S1	S2	S3	S4	VERNIER Position
20-30	0	0	0	0	0-10
25-35	5v	0	0	0	0-10
30-40	0	10v	0	0	0-10
35-45	5v	10v	0	0	0-10
40-50	0	0	20v	0	0-10
45-55	5v	0	20v	0	0-10
50-60	0	10v	20v	0	0-10
55-65	5v	10v	20v	0	0-10
60-70	0	0	0	40v	0-10
65-75	5v	0	0	40v	0-10
70-80	0	10v	0	40v	0-10
75-85	5v	10v	0	40v	0-10
80-90	0	0	20v	40v	0-10
85-95	5v	0	20v	40v	0-10
90-100	0	10v	20v	40v	0-10
95-105	5v	10v	20v	40v	0-10

2. VERNIER Control. This potentiometer varies the DC voltage over a range of 10 volts in each of the voltage bands. Clockwise rotation results in increasing voltage.

Thermostat and THERMAL OVERLOAD Indicator.

The manual reset-type thermostat is located on the rear deck. The thermostat opens when the temperature of the supply exceeds

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Set the switches and VERNIER to the position listed in Table I for the particular operating voltage range.

Table I Selection of Operating Voltage

Range VDC	Switch Positions S1	S2	S3	S4	VERNIER Position
20-30	0	0	0	0	0-10
25-35	5v	0	0	0	0-10
30-40	0	10v	0	0	0-10
35-45	5v	10v	0	0	0-10
40-50	0	0	20v	0	0-10
45-55	5v	0	20v	0	0-10
50-60	0	10v	20v	0	0-10
55-65	5v	10v	20v	0	0-10
60-70	0	0	0	40v	0-10
65-75	5v	0	0	40v	0-10
70-80	0	10v	0	40v	0-10
75-85	5v	10v	0	40v	0-10
80-90	0	0	20v	40v	0-10
85-95	5v	0	20v	40v	0-10
90-100	0	10v	20v	40v	0-10
95-105	5v	10v	20v	40v	0-10

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Thermostat and THERMAL OVERLOAD Indicator.

The manual reset-type thermostat is located on the rear deck. The thermostat opens when the temperature of the supply exceeds

Thermostat and THERMAL OVERLOAD Indicator (cont'd)

a maximum safe value. Input power is removed when the thermostat opens. The power supply must cool down for operation to be restored. Opening of the thermostat causes the THERMAL OVERLOAD indicator on the front panel to glow and the POWER ON light to extinguish. When proper temperature is reached, depress the manual THERMAL OVERLOAD RESET button to restore operation.

Connection Terminals.

Make all connections to the supply at the terminal block on the rear deck. Apply input power through the line cord or directly to terminals 1 and 2 if the line cord is removed. The supply positive terminal is brought out to terminals 3 and 4. The supply negative terminal is brought out to terminals 6 and 7. Recommended wiring of the power supply to the load and selection of wiring is shown in figures 1 through 6. Selection of the proper wiring is made on the basis of load requirements.

NOTE: Follow instructions for wiring supply to load.

Current Overload. (See ON-OFF circuit breaker)

The circuit breaker monitors the DC output current of the supply. A load current in excess of rated value or a short circuit causes the breaker to trip. The breaker can be placed back into operation immediately after removing the overload condition.

OUTPUT VOLTAGE Meter.

A 0-110 volts DC voltmeter, monitors the voltage at the output terminals of metered units.

OUTPUT CURRENT Meter.

0-2 ampere DC ammeter, monitors the load output current of metered units.

Fuses

"Slo-Blo" fuse F1, located on the rear deck, protects the AC input circuit and is rated at 8 amperes. Overload of the supply causes the circuit breaker to trip and does not cause fuse failure.

CAUTION

As a safety precaution, when the power supply is turned off for testing or servicing, discharge the internal electrolytic capacitors by briefly connecting a 100-ohm, 10-watt resistor across the output terminals (3 and 7) of the power supply.

POWER SUPPLY TO LOAD WIRING

The output impedance, regulation, and transient response of each power supply is so small that connecting leads of practical length can measurably effect these parameters at the load. Provisions have been made to overcome or to minimize the effects of these connecting leads.

The effect of the connecting leads and recommended methods of hookup to the power supply are shown in figures 1-6.

Figure 1 shows the connecting "Cable Voltage Drop per Ampere" versus "Cable Length" for the simple "2-Wire Connection."

Figure 2 shows the connecting "Cable Voltage Drop per Ampere" versus "Cable Length" for the "Improved 2-Wire Connection."

Figure 3 defines the separation distance from load to power supply.

Figure 4 illustrates the "2-Wire Connection." This is the simplest hookup and is suitable for most applications where extremely close load regulation and fast transient response over full-rated current excursion are not required.

Figure 5 illustrates the "Improved 2-Wire Connection." The number of terminals provided permit, in a practical way, the use of paralleled heavy gage leads. If the leads are not unduly long, this hookup yields excellent regulation and transient response.

Figure 6 illustrates the "4-Wire Connection." This hookup provides complete compensation for the connecting cable DC voltage drop. In addition, this connection provides good transient response for slow changes of load current.

When load current changes are rapid and good transient response is required together with remote sensing, consult the Lambda Engineering Department for recommended connections.

PROGRAMING AND CONSTANT CURRENT OPERATION

For programmed operation and constant current operation contact the Lambda Engineering Department for pertinent details.

GROUND CONNECTIONS

The power supply can be operated under the following conditions:

1. With negative terminal grounded
2. With positive terminal grounded
3. With neither terminal grounded

Proper connections for operating with either terminal grounded are shown in figures 4 through 6.

> NOTE: When operating the power supply with neither terminal grounded, high impedance leakage resistance and capacitance paths exist between the power supply circuitry and chassis ground.

REMOTE DC VERNIER CONTROL

The supply may be operated with remote DC Vernier control. Proper connections are shown in figures 4 through 6.

SERIES OPERATIONS

For operation of two (2) or more power supplies, of equal or unequal rating, in series, clamping diodes of suitable rating must be used across each of the power supplies to prevent reverse voltage from appearing across any of the individual supplies. This reverse voltage can appear under certain operating conditions and cause damage to the electrolytic output capacitors. Contact the Lambda Engineering Department for recommended diode rating and for other special application information.

VOLTAGE RATING (output terminals to chassis)

A maximum of 200 volts may be inserted between either the +DC or -DC terminal and chassis grounded.

OPERATING PROCEDURE

1. Remove AC power input to the supply before connecting load to the supply.

2. Select the proper power supply-to-load wiring by referring to the supply-load wiring diagram, figures 1 through 6.

3. Connect power supply to load in accordance with the applicable wiring diagram.

4. Refer to table 1 and select the desired operating voltage band.

5. Position the ON-OFF circuit breaker to the ON position to apply AC input power to the supply. Power supply is now operating at desired output voltage.

SAFETY NOTICE

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. OBSERVE THE USUAL SAFETY PRECAUTIONS WHEN OPERATING OR SERVICING THE EQUIPMENT TO AVOID SHOCK OR INJURY.

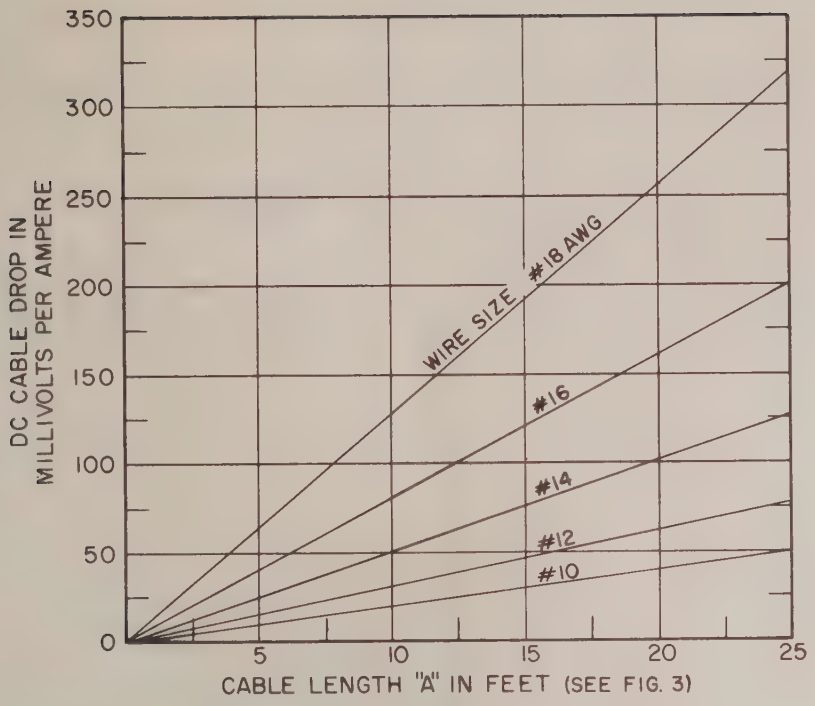


FIG.1. 2-WIRE CONNECTION (SEE FIG. 4)

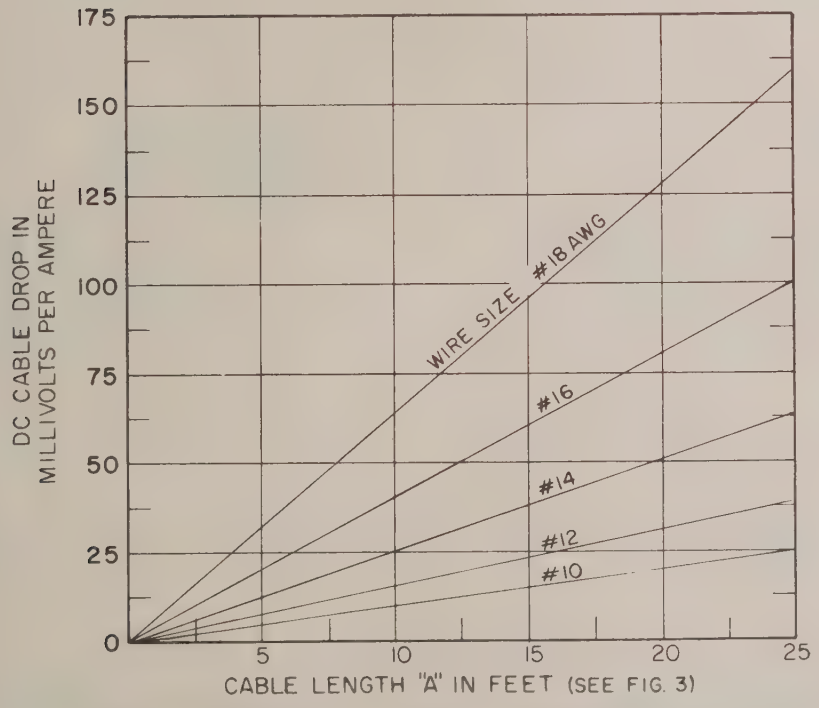


FIG. 2. IMPROVED 2-WIRE CONNECTION (SEE FIG.5)

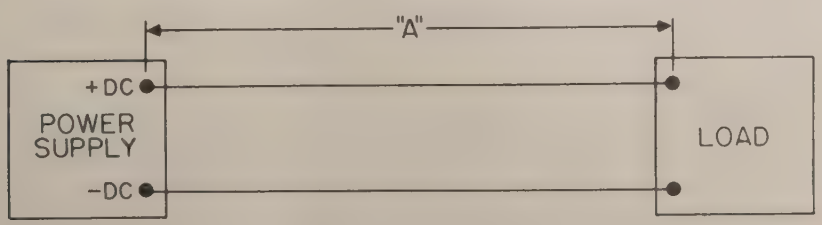


FIG. 3. CAB' E LENGTH "A" IN FEET

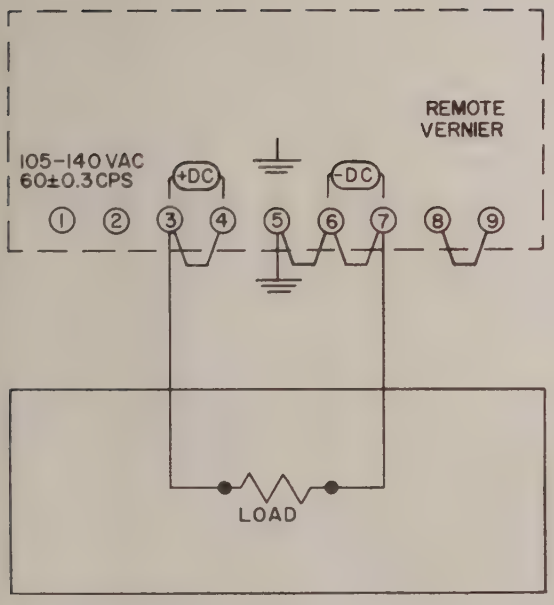


FIG. a
NEGATIVE TERMINAL GROUNDED

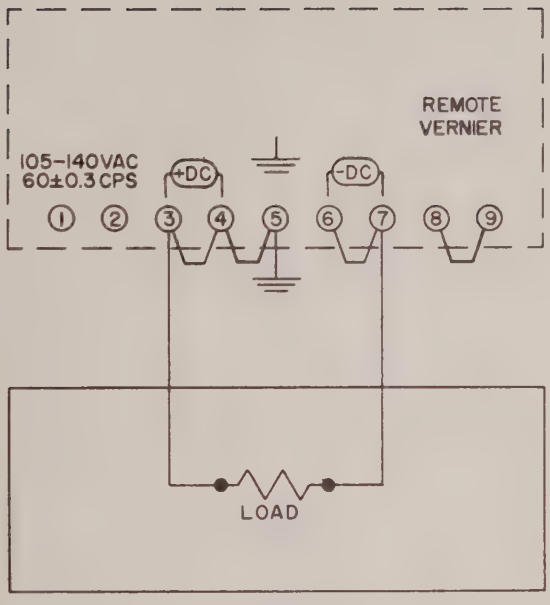


FIG. b
POSITIVE TERMINAL GROUNDED

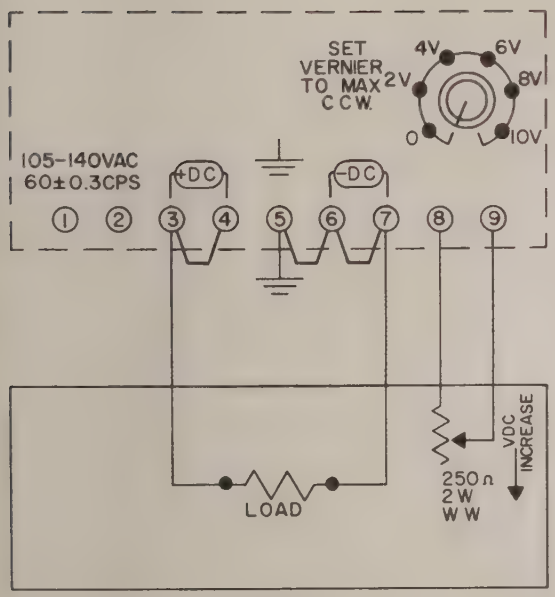


FIG. c
REMOTE DC VERNIER CONTROL
WITH NEGATIVE TERMINAL GROUNDED

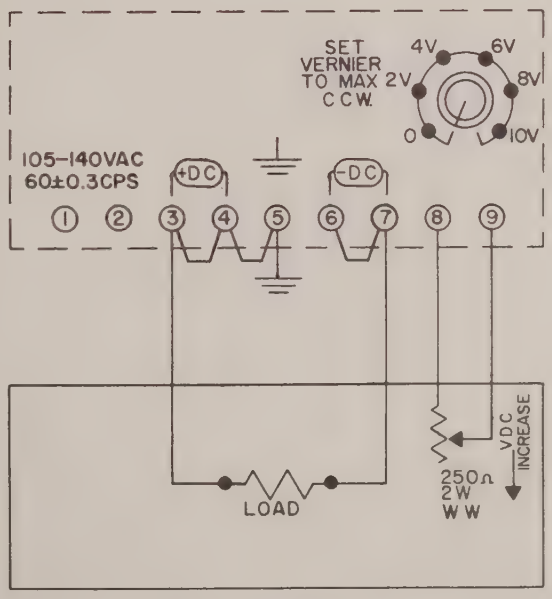


FIG. d
REMOTE DC VERNIER CONTROL
WITH POSITIVE TERMINAL GROUNDED

NOTE

SEE FIG.1 FOR SELECTION OF CONNECTING WIRE SIZE.

FIG.4. 2-WIRE CONNECTION

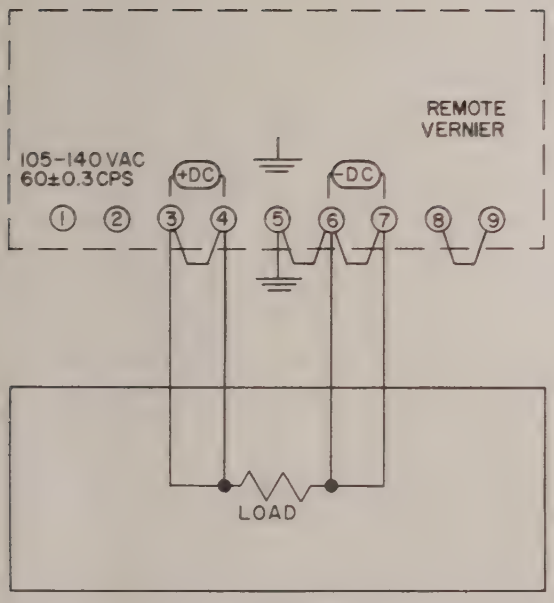


FIG. a
NEGATIVE TERMINAL GROUNDED

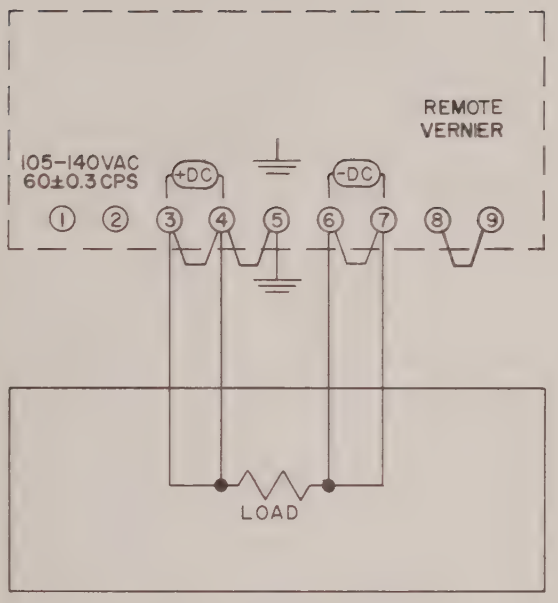


FIG. b
POSITIVE TERMINAL GROUNDED

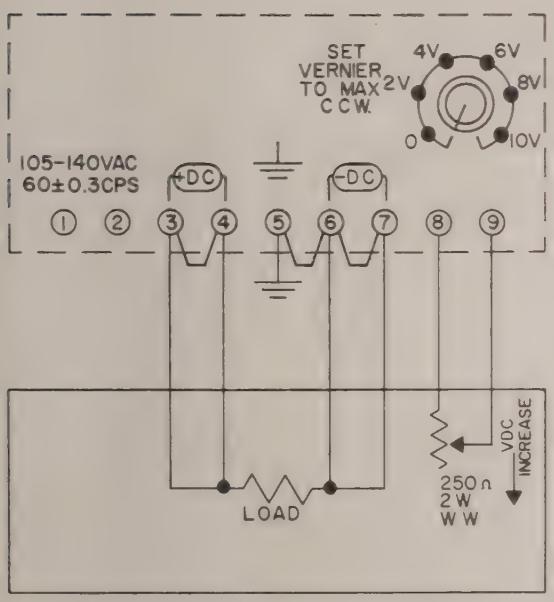


FIG. c
REMOTE DC VERNIER CONTROL
WITH NEGATIVE TERMINAL GROUNDED

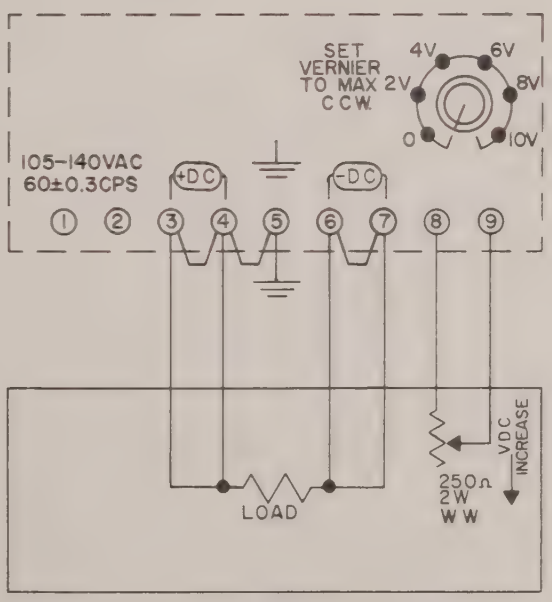


FIG. d
REMOTE DC VERNIER CONTROL
WITH POSITIVE TERMINAL GROUNDED

NOTE

SEE FIG.2 FOR SELECTION OF CONNECTING WIRE SIZE.

FIG. 5. IMPROVED 2-WIRE CONNECTION

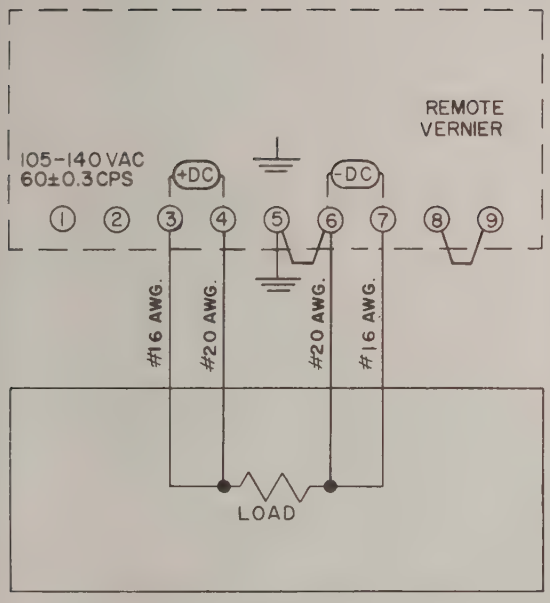


FIG. a
NEGATIVE TERMINAL GROUNDED

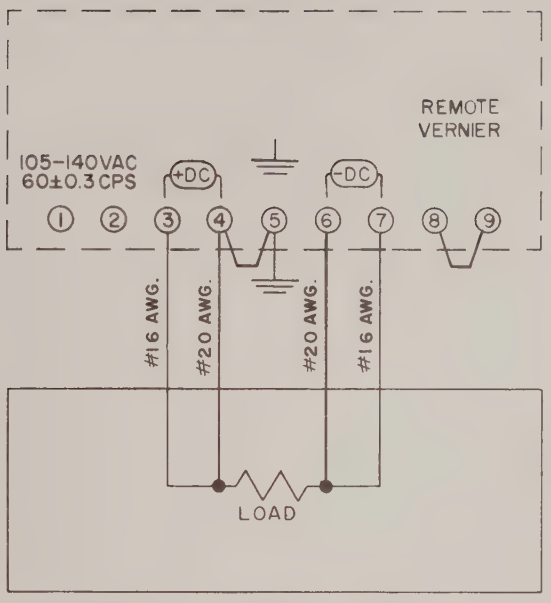


FIG. b
POSITIVE TERMINAL GROUNDED

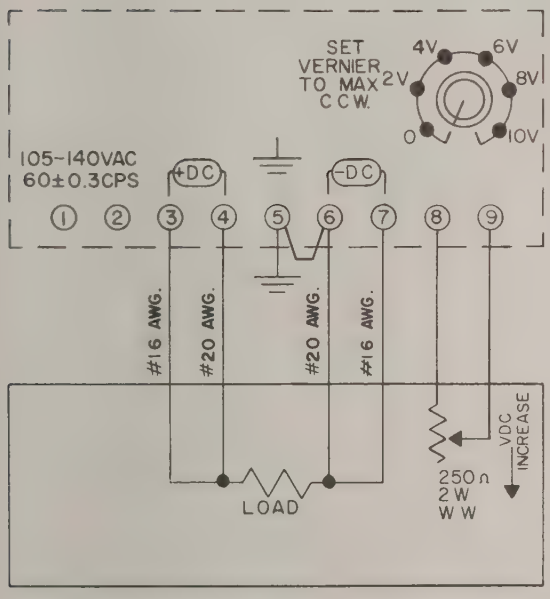


FIG. c
REMOTE DC VERNIER CONTROL
WITH NEGATIVE TERMINAL GROUNDED

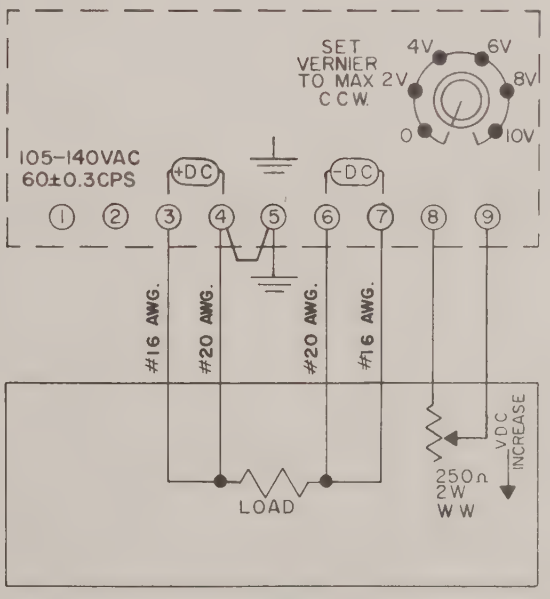
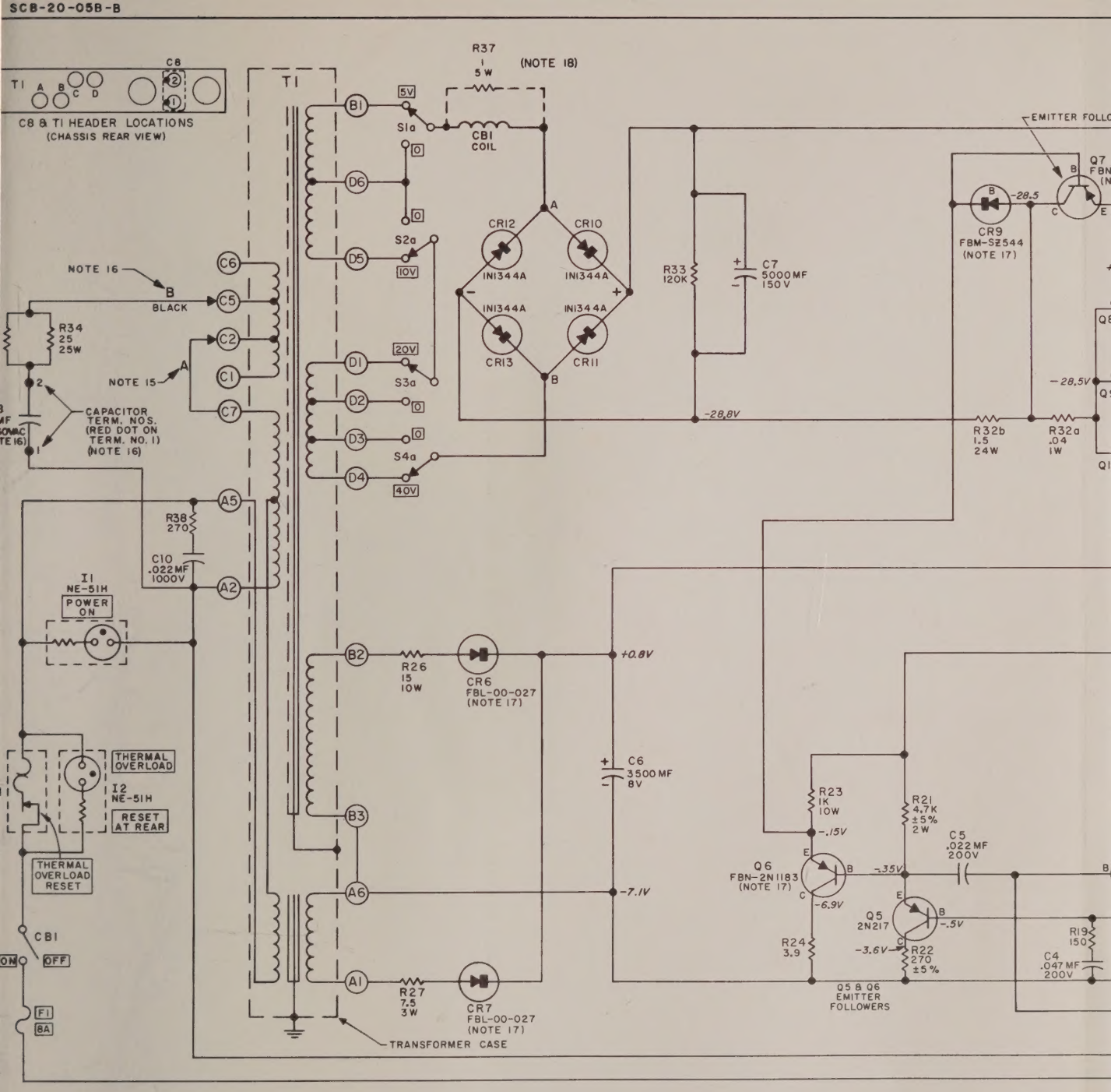
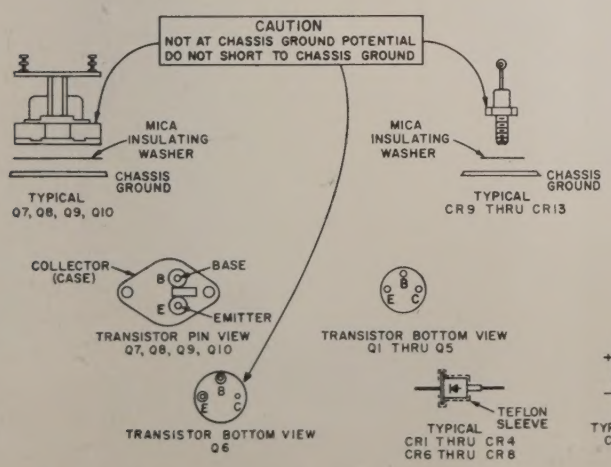


FIG. d
REMOTE DC VERNIER CONTROL
WITH POSITIVE TERMINAL GROUNDED

NOTE
WIRE SIZES SHOWN ARE MINIMUM.

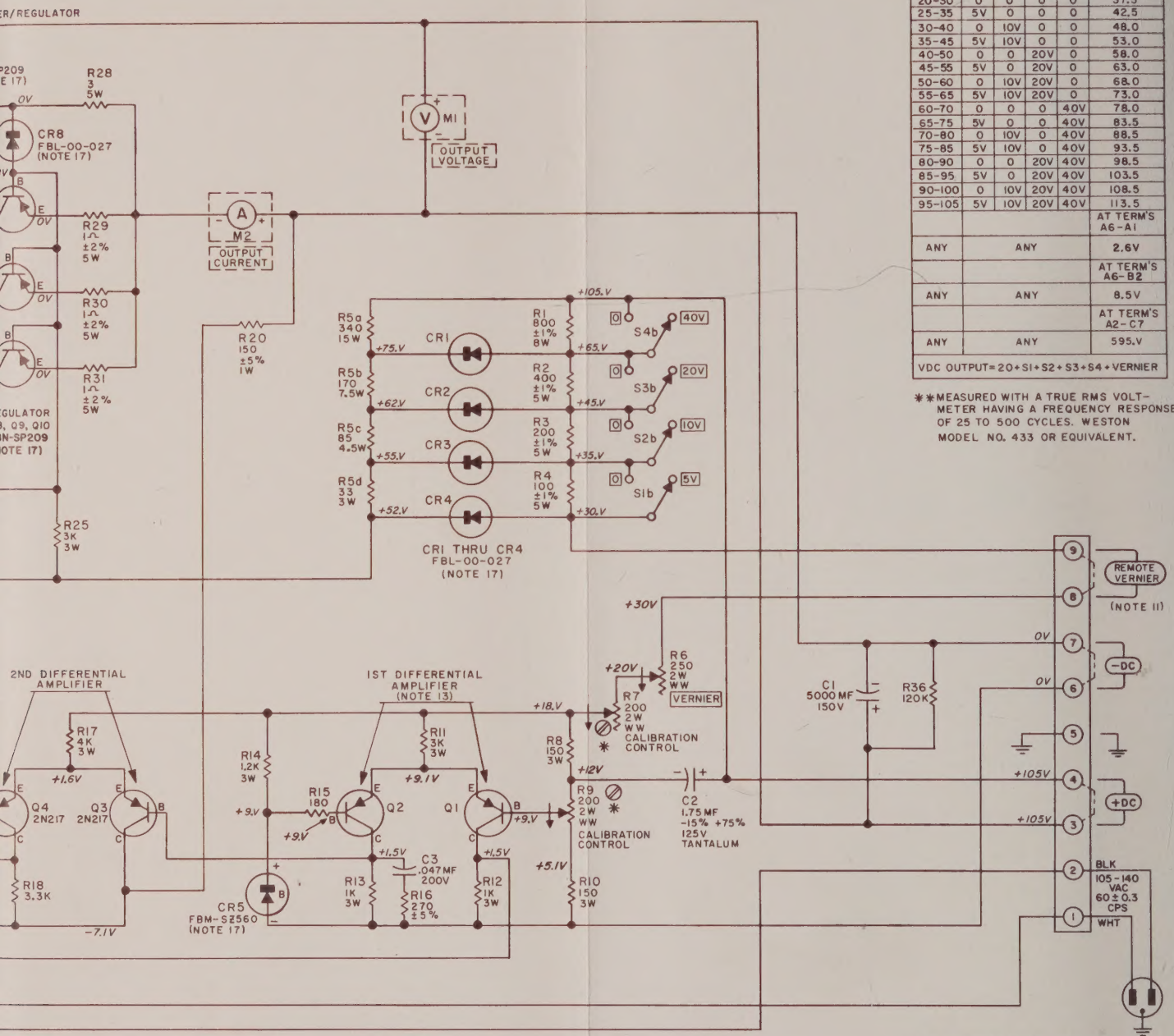
FIG.6. 4-WIRE CONNECTION





NOTES

1. WATTAGE RATING OF RESISTORS: 1/2 WATT, UNLESS NOTED.
2. TOLERANCE OF RESISTORS: COMPOSITION, ±10%; WIREWOUND, ±5%, UNLESS NOTED. ALL RESISTORS ABOVE 2 WATTS ARE WIREWOUND.
3. TOLERANCE OF CAPACITORS: ELECTROLYTIC, −0, +150%; PAPER, ±10%, UNLESS NOTED.
4. ↓ INDICATES CLOCKWISE ROTATION OF SHAFT.
5. ⏚ INDICATES CONNECTION TO CHASSIS.
6. ⊘ INDICATES SCREWDRIVER SLOT.
7. ✱ INDICATES FACTORY ADJUSTMENT, SEE INSTRUCTION MANUAL.
8. ◯ INDICATES TRANSFORMER HEADER TERMINAL.
9. ▭ INDICATES NOMENCLATURE AS ACTUALLY MARKED ON UNIT.
10. SWITCHES S1a,b, S2a,b, S3a,b, S4a,b, ARE DPDT TOGGLE SWITCHES.
11. FOR REMOTE DC VERNIER CONTROL SEE POWER SUPPLY TO LOAD WIRING DIAGRAMS IN INSTRUCTION MANUAL.
12. CONDITIONS OF VOLTAGE MEASUREMENT:
    A. INPUT: 125 VAC
    B. OUTPUT VOLTAGE: 105 VDC, OUTPUT CURRENT ZERO.
    C. INDICATED VOLTAGES ARE TYPICAL VALUES & ARE DC, UNLESS NOTED.
    D. MEASUREMENTS MADE USING 20,000 OHMS/VOLT METER BETWEEN "−DC" (TERM. #6 OR #7) & INDICATED POINTS, UNLESS NOTED.
13. THE INPUT DIFFERENTIAL AMPLIFIER (Q1 & Q2) UTILIZES A PAIR OF MATCHED TRANSISTORS WHICH SHOULD BE REPLACED AS A PAIR, OBTAINABLE FROM LAMBDA AS PART # FBN-2N2217MP. (COMPRISES MATCHED PAIR).
14. FUSE IS TYPE 3AG, "SLO-BLO".
15.
16.
17.
18.



DC OUTPUT					AC ** VOLTS RMS
RANGE VDC	SWITCH POSITION S1	S2	S3	S4	AT RECT. TERMINALS A-B
20-30	0	0	0	0	37.5
25-35	5V	0	0	0	42.5
30-40	0	10V	0	0	48.0
35-45	5V	10V	0	0	53.0
40-50	0	0	20V	0	58.0
45-55	5V	0	20V	0	63.0
50-60	0	10V	20V	0	68.0
55-65	5V	10V	20V	0	73.0
60-70	0	0	0	40V	78.0
65-75	5V	0	0	40V	83.5
70-80	0	10V	0	40V	88.5
75-85	5V	10V	0	40V	93.5
80-90	0	0	20V	40V	98.5
85-95	5V	0	20V	40V	103.5
90-100	0	10V	20V	40V	108.5
95-105	5V	10V	20V	40V	113.5
					AT TERM'S A6-A1
ANY	ANY				2.6V
					AT TERM'S A6-B2
ANY	ANY				8.5V
					AT TERM'S A2-C7
ANY	ANY				595.V
VDC OUTPUT = 20+S1+S2+S3+S4+VERNIER					

**MEASURED WITH A TRUE RMS VOLTMETER HAVING A FREQUENCY RESPONSE OF 25 TO 500 CYCLES. WESTON MODEL NO. 433 OR EQUIVALENT.

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO POWER SUPPLY-TO-LOAD WIRING DIAGRAMS

DOTTED CONNECTIONS ABOVE INDICATE JUMPERS IN PLACE FOR "2 WIRE CONNECTION"

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A & B

ONNECTION "A" IS A PERMANENT FACTORY VOLTAGE ADJUSTMENT WHICH CONNECTS ERMINAL C7 TO ONE OF TERMINALS C1, C2, C5 OR C6 DO NOT REMOVE.

ERMINALS C1, C2, C5 & C6 ARE VOLTAGE ADJUSTMENTS FOR C8 CAPACITOR OLERANCE. REPLACEMENT CAPACITOR IS LAMBDA PART NO. CAN-40-019.

ONNECT WIRE "B" AS FOLLOWS:

CAPACITOR TOLER. COLOR CODE ON TERMINAL #2	CONNECT WIRE "B" TO TERMINAL:
BLACK	C6
YELLOW	C5
GREEN	C2
BLUE	C1

ESIGNATIONS ARE LAMBDA PART NUMBERS.

ESISTOR R37 IS ONLY USED ON UNITS BEARING SERIAL NO. PREFIX A.

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY
MODEL LA 20-05B, LA 20-05BM

METERS INCLUDED IN "M" MODELS ONLY

LAMBDA
ELECTRONICS CORP.
MELVILLE, L. I., NEW YORK

λ

5-Year Guarantee

We warrant each instrument manufactured by us, and sold by us or our authorized agents, to be free from defects in material and workmanship, and that it will perform within applicable specifications for a period of five years after original shipment. Our obligation under this guarantee is limited to repairing or replacing any instrument or part thereof, (except tubes and fuses) which shall, within five years after delivery to the original purchaser, be returned to us with transportation charges prepaid, prove after our examination to be thus defective.

We reserve the right to discontinue instruments without notice, and to make modifications in design at any time without incurring any obligation to make such modifications to instruments previously sold.

LAMBDA ELECTRONICS CORP.

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